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ABSTRACT

The "Web of Life," adapted from the green version of the Biological Sciences Curriculum Study (BSCS), has gained a virtual monopoly in Australian upper secondary school biology classrooms since its introduction in 1967. A recent increase in the diversity of student interests, academic abilities, attitudes, and vocational aspirations has generated formal evaluation and informal debate among biology teachers regarding the appropriateness of the present course. This study investigated the degree of satisfaction-dissatisfaction of the "Web of Life" course as indicated by 60 experienced teachers. The development of the Teachers' Perception and Opinion Questionnaire (TPOQ) was described. Nine categories measured by 50 items of the TPOQ were: (1) curriculum materials; (2) curriculum content; (3) learning skills; (4) philosophy of the course; (5) assessment of student achievement; (6) tertiary entrance exam; (7) management; (8) teacher characteristics; and (9) student characteristics. Teachers' responses by categories and items were reported. The highest satisfaction was related to the curriculum package and the highest areas of dissatisfaction were related to the externally set examination, the current population of students, and the knowledge and skills of biology teachers. The paper concludes with recommendations for improving inquiry teaching and for developing an alternative course to cater for the diverse range of students. (YP)

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TEACHERS' DEGREE OF SATISFACTION CONCERNING THE IMPLEMENTATION OF AN INQUIRY-ORIENTED SECONDARY BIOLOGY COURSE

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ABSTRACT

TEACHERS' DEGREE OF SATISFACTION CONCERNING THE IMPLEMENTATION OF AN INQUIRY-ORIENTED SECONDARY BIOLOGY COURSE

The Web of Life has gained a virtual monopoly in Australian biology classrooms since its introduction in 1967. Recently, increases in upper school retentivity has brought a greater diversity of student interests, academic abilities, attitudes and vocational aspirations. These factors have generated formal evaluation and informal debate among Australian biology teachers regarding the appropriateness of the present course. The study sought to investigate this debate by gauging the degree of satisfaction - dissatisfaction of the Web of Life course as indicated by 60 experienced biology teachers. Perceptions and opinions about the implementation of the course were collected using an instrument where each item comprised two parts which respectively elicited teachers' perceptions and opinions. A tally of the response patterns for each item determined the degree of satisfaction/dissatisfaction. Highest satisfaction was related to the curriculum package and highest dissatisfaction was related to the externally set examination, the current population of students, and the knowledge and skills of biology teachers. The paper concludes with recommendations for improving inquiry teaching and for developing an alternative course to cater for the diverse range of students studying biology in upper school.

TEACHERS' DEGREE OF SATISFACTION CONCERNING THE IMPLEMENTATION OF AN INQUIRY-ORIENTED SECONDARY BIOLOGY COURSE

Introduction

The Biological Sciences Curriculum Study has now been in existance for almost 30 years and has been used in over 70 countries and translated into over 19 languages. During this time the overall goal of the implemented BSCS curricula was to represent biology as a series of inquiry-related learning experiences so that biology would be viewed by the students as a narrative of inquiry instead of a the rhetoric of conclusions (Klinckmann, 1970) and would be portrayed as an inseparable mix of knowledge and scientific skills. In Australia, the green version of BSCS was adapted and became the Web of Life which was introduced into Australian secondary schools in 1967 and taught as a two year course in grades 11 and 12. Since that time the Web of Life has undergone a number of revisions and is now a typically Australian biology course. The success of the implementation of the Web of Life can be gauged by the fact that by 1980 the Web of Life had gained a virtual monopoly in biology classrooms (Lucas, 1980a, b). However, by 1990 alternative textbooks and courses are being considered in some States.

During the 20 years that the Web of Life has been used in Australian biology classrooms, much has happened to the upper secondary school student population. When the Web of Life course was first introduced in 1967 retention rates of students into grades 11 and 12 from grade 10 was approximately 30% (McGaw, 1984), while in 1987 this figure was over 80% (Ministry of Education, 1988). This increase in retention rate has brought with it a greater diversity of student interests, academic abilities, attitudes and vocational aspirations. By 1985, there were 50,000 biology enrolments Australia-wide (Dekkers, de Laeter and Malone, 1986) and this number was more than double the number of students enrolled to study biology when Web of Life was first introduced. These issues have generated some formal evaluation (see for example,

Dowd and Dekkers, 1980) and much informal debate among biology teachers regarding the appropriateness of the present course for the student population. This study sought to investigate this debate in a formal manner by investigating science teachers' perceptions and opinions concerning the implementation of the Web of Life course.

Few studies would appear to have investigated what teachers think of the curriculum they are required to teach. However, a study by Dreyfus, Jungwirth and Tamir (1985) which examined the subjective concerns and perceptions of the BSCS - derived curriculum by biology teachers in Israel provided direction for conducting the present study. The results of the Dreyfus et al. study showed that while teachers were concerned about the impact of the national biology examination, they supported the philosophy and flexibility of the inquiry-oriented curriculum. However, due to the compulsory nature of the curriculum and the administrative set-up of public education in Israel, teachers were concerned about being "fenced-in". Nevertheless, the authors of this Israeli study felt that this perception amongst teachers was greater than is actually the case.

The major objective of the study was to gauge the degree of satisfaction - dissatisfaction of the Web of Life course as indicated by a group of experienced biology teachers. The paper describes the development of a questionnaire designed to investigate biology teachers' perceptions and opinions about the implementation of an inquiry-oriented curriculum; reports on the findings when this questionnaire was administered to a sample of experienced biology teachers; and recommends how appropriate inquiry-oriented biology courses can be best taught to upper secondary grade students.

Procedure

The Web of Life Biology Course

Students in Western Australia study the Web of Life course in their final two years of high school. In grade 11 they cover major ideas associated with diversity,

interrelationships, adaptations, and changing patterns and the world; The grade 12 course deals with organs and systems, cells and molecules, continuity of life, and evolution. The major ideas associated with the processes of science are ongoing and are covered throughout both years of study. At the end of grade 12, students sit for a statewide Tertiary Entrance Examination (TEE) in Biology and in other courses they have been studying during their final year of school. Prior to 1986, the Tertiary Entrance Examination covered the work studied by students in both grades 11 and 12. Under the current system the TEE only examines the grade 12 course work. A student's performance in each of these TEE courses is combined with an assessment from his/her school (50% : 50%) to give an aggregate which is used by colleges and universities to select students for the various courses offered. The fifty percent from the school is moderated.

Instrumentation

An instrument entitled Teachers' Perception and Opinion Questionnaire (TPOQ) was used to collect data on biology teachers' satisfaction/dissatisfaction about the Web of Life course. The strategy adopted for the development of the instrument consisted of five stages, namely, (1) identifying issues of concern generated by a group of 12 experienced biology teachers, (2) categorising the concerns, (3) validating the categories, (4) developing the questionnaire format and (5) trialling the questionnaire. A total of 50 items made up nine categories shown in Table 1.

Identifying Teacher Concerns. Twelve experienced biology teachers were engaged in a brainstorming session to generate concerns about the most positive and the most negative aspects of the Web of Life course. The session used a modified Nominal Group Technique which involved silent generation of concerns, round-robin collection of concerns, serial discussion for clarification, and assigning concerns to categories.

Categorizing the concerns. The twelve teachers also identified nine categories (see Table 1) into which the generated concerns fitted. Most of the concerns were placed in these nine categories except for those which were deemed beyond the scope of the study and these were disregarded.

Validating the categories. One week after the brainstorming session, copies of the concerns placed in each of the nine categories were forwarded to each of the 12 teachers who were asked to scrutinise the concerns in each category and comment on the suitablity of their placement in that category and the wording. Returned comments from these teachers resulted in a total of 50 concerns in nine categories that were used in the final questionnaire. The 12 teachers were sent a copy of these 50 categorised concerns and invited to make any final comment.

Developing the questionnaire format. Although this study has a similar goal to that of Dreyfus et al. (1985), their mapping-sentence format was not used for the construction of the questionnaire. Instead, a two part sentence was used where each concern was described by an "a" and "b" part. The "a" sentence sought to uncover a teacher's perceptions of a concern, and the "b" sentence sought the teacher's opinion about that concern. For each sentence teachers were asked whether they agreed or disagreed. Teachers were asked to respond to each part of the item with an agree/disagree response. For each item there were four possible responses. By combining responses it is possible to determine a respondent's message which tells how he/she feels about a particular concern as described by an item. Consider the following item shown in Figure 1.

Figure 1 about here

As some of the items are worded negatively, the given responses described in Figure 1 for item 24, do not always hold as indicators of the degree of satisfaction or dissatisfaction. For example, item 4 states:

4a The curriculum materials require students to do a great deal of reading

4b The curriculum materials should not require students to do a great deal of reading

For this item satisfaction would be indicated by either a 4a 'disagree'/4b 'agree' response pattern or by a 4a 'agree'/4b 'disagree' response pattern. Dissatisfaction is indicated by either a 4a 'agree'/4b 'agree' or by a 4a 'disagree'/4b 'disagree' response pattern.

Trialling the questionnaire. A version of the questionnaire was trialled by 10 experienced biology teachers who were not part of the previously described teachers who identified their concerns. However, in addition these previous 12 teachers were asked to provide any editorial comments.

Scoring. Satisfaction/dissatisfaction can be reached from different points of perception. By tallying the number of response patterns for each item it was possible to determine a degree of satisfaction/dissatisfaction as expressed by the biology teachers who responded to this questionnaire. The degree of satisfaction/ dissatisfaction was determined to be high where overall teacher response was >75%, moderate where overall teacher response was 60-74%, undecided where overall teacher response was 40-59%.

Sample

The TPOQ was sent to 80 biology teachers in government and non-government schools in metropolitan and country areas in Western Australia. This sample, which included male and female teachers, represented about 20% of known biology teachers

who satisfied the criteria of 3 years minimum teaching experience, had taught both grades 11 and 12 Web of Life biology, were currently teaching grade 11 and currently were using Web of Life curriculum materials. The response rate was 75% (n = 60), for the main body of the questionnaire, with 32 of the 60 teachers completing the open-ended section of the questionnaire.

Results

Table 1 gives a summary of the teachers' degree of satisfaction/dissatisfaction with items from the nine categories. From these data it can be inferred that the teacher sample expressed strong satisfaction with 23 items and moderate satisfaction with 8 items related to the intrinsic concerns of the Web of Life course. Teachers were undecided with 11 items and showed strong or moderate dissatisfaction with 8 items. Looking more closely at each of these categories gives more precise information about teachers' perceptions and opinions about various concerns and their degree of satisfaction/dissatisfaction.

Table 1 about here

Curriculum Materials

The data on curriculum materials in Table 2 show that there is a strong degree of satisfaction (>75%) for five items in this category. More than 75% of teachers are satisfied that the curriculum materials are visually appealing (item 1), allow flexibility of programming (item 2), contain major ideas that are well integrated (item 5), allow teachers diversity of time use (item 6), and have clearly defined aims/objectives (item 7). There is moderate satisfaction that the curriculum materials challenge the academically able student (item 9), and with the amount of reading students are required to do (item 4). However teachers are undecided about the curriculum

materials being textbook-centred (item 3) and whether or not they inhibit teacher creativity (item 8). Overall the message from teachers regarding curriculum materials for the Web of Life course is one of satisfaction.

Table 2 about here

Curriculum Content

The message from teachers regarding curriculum content as shown in Table 2 is one of strong support, since the degree of satisfaction for three items is strong and for the other two it is moderate. There are no items about which teachers are undecided or show moderate or strong dissatisfaction. Teachers are highly satisfied that the content objectives are clearly described (item 10) and that Australian biology is adequately represented (item 11). The high degree of satisfaction (78.3%) that the Web of Life covers all levels of biological organization (item 13) consists of 56.7% who agree that all levels of organization are covered, as they should be, and 21.6% who disagree that all levels of organization are covered and they are of the opinion that all levels should not be covered.

Sixty seven percent of the teachers are moderately satisfied that the biology of Web of Life is relevant to students' needs (item 12). The degree of satisfaction for item 14 which considered the overlap between biology and human biology was also moderate at 63.4%; it should be noted that 83% of teachers support the opinion that the Web of Life should not contain too much human biology content. No doubt this high figure reflects the high regard with which the Human Biology course is held in Western Australian schools.

Learning Skills

As indicated by the data in Table 3, teachers show a high degree of satisfaction for three of the five items in this category. Eighty eight percent of teachers are satisfied that the Web of Life fosters learning skills relevant to the processes of science (item 15) and that 93.2% are satisfied that these learning skills are transferable to everyday life situations (item 16). Teachers are satisfied that there were few facts to learn (item 18) but this high degree of satisfaction is based on 50% of teachers who gave a disagree/disagree response pattern and 26.7% of teachers who gave an agree/agree response pattern. That half as many teachers perceive that there are few facts to learn compared to teachers who believe there are not few facts to learn, could be considered in future research.

Teachers are undecided in their responses of satisfaction about the difficulty of the concept approach for students (item 17) and the number of guide questions and problems that students have to do (item 19). Seventy one percent of teachers agree that the concept approach is too difficult for many students, and of these, 39% are of the opinion that this should not be the case, 32% of teachers believe that the concept approach should be difficult for many students. When these two sets of responses are added together, the degree of satisfaction is 55.9% and the degree of dissatisfaction is 44.1%. A similar response pattern exists for item 19.

Table 3 about here

Philosophy of the Course

Teachers are strongly satisfied (see Table 3) with five of the eight items in this category (items #20 - 24) and support these aspects of the Web of Life course. These data show therefore that teachers have strong support for the philosophical basis (item 20) and scientific approach (item 22) of the course. Teachers are also highly satisfied with the

inquiry based nature (item 21) of the Web of Life course in that it allows for much experimental activity (item 23) and that the course is student centred (item 24).

However, the respondents are undecided about whether teachers have a clear understanding of the philosophy of the course (item 25) and whether most students gain much from inquiry-based activities (item 26). There is strong dissatisfaction among the teacher sample about the way teachers are prepared to teach the Web of Life course (item 27).

Assessment of Student Achievement

Teachers show a strong degree of satisfaction for three of the five items in this category as shown in Table 4. Teachers are satisfied that specific objectives can be readily assessed (item 29), that teachers do not need to assess all the objectives (item 30), and that some objectives of the course need not be assessed (item 31). There is moderate satisfaction that the general objectives of the course can be readily achieved by students (item 28). Teachers responded differently to items 28 and 29, indicating that the assessment of general objectives is not as readily achievable by students as is the assessment of specific objectives. This is most likely attributable to specific objectives being easily assessed using multichoice and short answer questions, whereas the general objectives are more likely to be assessed using extended, essay type questions. Many students have difficulty writing well structured, knowledgeable essays, and these questions are more difficult to assess.

The teachers provided a range of responses about whether the course allows students to assess their own learning (item 32), with 22% agreeing and 78% disagreeing. However, 81.3% of teachers agree that the curriculum materials should allow students to assess their own learning but they do so with a different perception. Teachers are undecided about the Web of Life course enabling students to assess their own learning; 40.7% of teachers are satisfied and a 59.3% are dissatisfied.

Tertiary Entrance Examination

None of the five items have a high degree of satisfaction for this group of respondents. Teachers are moderately satisfied that the TEE is a reliable indicator of ability in biological science (item 33), and that it adequately tests objectives in the syllabus (item 34). However, there is also a significant degree of dissatisfaction for both these items (item 33, 37.3%; item 34, 39.0%). A reasonable number of teachers do not support the idea that the TEE is able to assess ability in biological science and the biology syllabus.

Teachers are moderately dissatisfied (item 35) by the fact that the type of questions used in the TEE influences the type of course taught by the teachers; 86.7% of teachers agree that this influence exists and 71.7% of the teachers disagree that this should be the case. Only 13.3% of teachers disagree that the TEE influences the course taught by teachers. The moderate degree of dissatisfaction indicates that teachers are not accepting the influence exerted by the TEE.

There is also moderate dissatisfaction with the belief that teachers overemphasised the importance of the TEE (item 36) and that the TEE restricts the more able student from pursuing their own interests in biology (item 37). A large percentage of teachers (71.2%) perceive that the TEE restricts the more able students from pursuing their own interests in biology (item 37). These responses are comparable with those for item 36. The fact that a student's result from the TEE contributes to his/her tertiary entrance aggregate is no doubt constantly the stimulus to concentrate on spending much available time on obtaining a good TEE score. With such a strong stimulus, there is little incentive to branch out and become involved with any extra curricular biology.

Management

As shown in Table 4 there is a high degree of satisfaction for three of the four items in this category (items 38, 39, 41). Teachers agree in both their perception and opinion that most lessons being conducted in laboratories (item 38) does and should occur.

Teachers also agree in perception and opinion that students are and should be expected to carry a high work load outside school hours (item 39). There is also a common perception and opinion amongst teachers that class size does make a difference to the effective use of inquiry learning modes (item 41).

Teachers are clearly undecided in their satisfaction about the effect that school administrative decisions have on teacher/student contact time in biology (item 40). The indecision is based on a difference in perception that the concern described in item 40 is or is not occurring. As far as opinion is concerned, there is agreement in what teachers have expressed; 93.3% believe that school administrative decisions should not reduce teacher/student contact time in biology.

Table 4 about here

Teacher Characteristics

As shown in Table 5, although the respondents are satisfied that teachers have the scientific background to teach the Web of Life course (item 45), they are not satisfied to the same extent about the other four items in this category. The majority of respondents (61.7%) do not believe that teachers have the skills to conduct an inquiry learning mode of teaching (item 42) but nearly all (98.3%) of them believe that they should have these skills. Teachers differ in both perception and opinion as to whether teachers have and should have the desire to use an inquiry learning mode of teaching (item 43) and whether an inquiry learning mode is or should be a productive way to teach biology (item 44). Teachers are highly dissatisfied with the inservice available for Web of Life (item 46) with 85.7% disagreeing that there was enough inservice time available to help teachers improve their skills in inquiry teaching.

In this category item 44 shows the greatest amount of indecisiveness about satisfaction. While the respondents agree that most teachers believe that an inquiry learning mode is a productive way to teach biology, 57.6% disagree with this perception. In terms of whether most biology teachers hold the opinion that inquiry learning should be a productive way to teach biology, 78.0% of respondents agree and 22.0% disagree. As with other items in this category, while teachers have strong opinions, they have undecided perceptions.

Table 5 about here

Student Characteristics

It is significant that there are no items in this category where there is a moderate or high degree of satisfaction (see Table 5). In fact teachers are moderately dissatisfied with the amount of biology work students do outside class (item 50), and with the decline in the proportion of high ability students in their classes (item 49). Teachers are undecided about students' priority for academic achievement (item 47) and the large proportion of low ability students in their classes (item 48).

A key aspect of the responses in this category is the perceived quality of students now studying the Web of Life course. Sixty six percent of teachers perceive that there is a large proportion of low ability students in biology classes (item 48) while 34.0% disagree. Seventy six percent of teachers are of the opinion that this situation should not exist and 23.7% agree that it should be the case. Although the degree of dissatisfaction for this item is 55.9% it falls into the undecided satisfaction category.

Similarly 68.3% of teachers perceive there is a decline in the proportion of high ability students in biology classes, which 31.7% disagree with this statement (item 49). That there should not be a decline in the number of high ability students in biology classes

is an opinion supported by 95% of teachers. In calculating degree of satisfaction/ dissatisfaction, 63.3% are dissatisfied with this issue: teachers do believe that there is a decline in the proportion of high ability students in biology classes and they believe that this situation should not exist.

Conclusions

The teachers' degree of satisfaction/dissatisfaction identified in this study was generally not directly related to the Web of Life curriculum materials. While teachers showed some mild dissatisfaction about the amount of reading students were required to do and the course being textbook-centred, there was clear satisfaction with the curriculum materials, the biological content and the underlying philosophical and scientific basis of the Web of Life course. Teachers did not agree however in their perception about whether or not most students gain much from the inquiry based activities of the course.

Teachers are satisfied with 20 of the 27 (74%) curriculum concerns investigated (these are found in the categories, Curriculum Materials, Curriculum Content, Learning Skills and Philosophy of the Course), and only dissatisfied with 1 out of 27 (4%). Consequently, while there may be some concerns with which teachers are undecided, on the whole teachers in this study are satisfied with the Web of Life curriculum package.

The influence of the Tertiary Entrance Examination on the way teachers teach the Web of Life course is a concern amongst the teachers in this study. While teachers accept that the TEE is a reliable indicator of ability in biological science and that it adequately tests the biology syllabus objectives, teachers are dissatisfied with the influence that the TEE has on teachers and how they implement the curriculum. Teachers are concerned that the type of course they teach is influenced by their overemphasis on the importance of the TEE. Since 83% of teachers hold the opinion

that the type of questions used in the TEE should not influence the way they teach the Web of Life course, and 74.6% of teachers hold the opinion that they should not overemphasise the importance of the TEE, it can be concluded that the externally set examination exerts too much influence on how teachers implement the Web of Life course.

Teachers are concerned about some aspects about their own ability to teach the Web of Life course. While teachers believe they have the scientific background to teach the Web of Life course, they have indicated that most teachers do not have the skills necessary to conduct an inquiry learning mode of teaching. That teachers are dissatisfied with the level of pre-service training provided to graduate teachers and the strong perception that there is not enough teacher in-service on inquiry learning, suggests that this problem will not improve. It can be concluded therefore that the respondents hold the opinion that many teachers do not have the skills necessary to carry out the inquiry related activities of the Web of Life course.

Teachers are dissatisfied with the characteristics of the student population that they teach. Concern is expressed at the decline in the proportion of high ability students in biology classes, with teachers generally agreeing (66%) that there is a large proportion of low ability students in biology classes as well. While some teachers agree (64.4%) that motivation for high academic achievement has a low priority rating for most of today's grade 11 and 12 students, 71.2% of teachers perceive that most students do not spend adequate time doing biology work out of class contact time. It can be tentatively concluded, in the light of Sanford's (1984) findings on the relationship between academic ability, reasoning ability and performance on inquiry related activities, that the composition of today's biology student population is not conducive to effective inquiry learning.

While the results from the questionnaire show many favourable perceptions and opinions about the Web of Life course and illustrate aspects with which the teachers

are highly satisfied, there are several aspects with which teachers are dissatisfied. In order to address these dissatisfactions it is recommended that a greater emphasis on the understanding of and the role of inquiry in teaching biology be made in preservice teacher education programs; preservice teacher placement be made with supervising practice teachers who are sympathetic to the teaching strategies intended by Web of Life course developers; a greater commitment be made by teacher employing authorities and professional bodies to conduct significant teacher in-service training in inquiry learning; a greater commitment be demonstrated by teachers to attend such in-service programs; and an alternative version of the Web of Life course be developed for less academically-oriented students (non-tertiary bound) who currently make up 52% of the present biology student population in Western Australian secondary schools. If these recommendations are implemented, there is every reason to believe that the Web of Life course will be better matched to the changing student population and implemented by competent practitioners in the manner intended by the course developers.

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TABLE 1

A summary of teachers' degree of satisfaction/dissatisfaction for each of the nine categories of the TPOQ

Category	No. of items	Satisfaction			Dissatisfaction	
		High >75%	Moderate 60%-74%	Undecided 40%-59%	High >75%	Moderate 60%-74%
Curriculum materials	9	5	2	2	-	-
Curriculum content	5	3	2	-	-	-
Learning skills	5	3	-	2	-	-
Philosophy of the course	8	5	-	2	1	-
Assessment of student achievement	5	3	1	1	-	-
Tertiary Entrance Exam	5	-	2	-	-	3
Management	4	3	-	1	-	-
Teacher characteristics	5	1	1	1	1	1
Student characteristics	4	-	-	2	-	2
TOTAL	50	23	8	11	2	6

TABLE 2

Teacher responses to the items in the categories Curriculum Materials and Curriculum Content

	Item	Responses to part (a) and (b) (a)Agree (b)Agree n(%)	Agree Disagree n(%)	Disagree Agree n(%)	Disagree Disagree n(%)	Degree of Satis-faction %	Dissatis-faction %
	Curriculum Materials						
1	Visually appealing	46(76.7)	0	13(21.7)	1(1.6)	78.3	21.7
2	Flexibility of programming	52(86.7)	0	8(13.3)	0	86.7	13.3
3	Textbook-centred (1)	26(43.3)	18(30.0)	14(23.3)	2(3.4)	53.3	46.7
4	Great deal of reading (1)	21(35.0)	32(53.3)	4(6.7)	3(5.0)	60.0	40.0
5	Major ideas well integrated	46(76.7)	0	13(21.7)	0	76.7	21.7
6	Diversity of time use	48(80.0)	0	11(18.4)	1(1.6)	81.6	18.4
7	Clearly defined aims/objectives	54(90.0)	0	6(10.0)	0	90.0	10.0
8	Inhibit teacher creativity (1)	22(36.7)	0	35(58.3)	3(5.0)	58.3	41.7
9	Challenge academically able students	41(68.3)	0	16(26.7)	3(5.0)	73.3	26.7
	Curriculum Content						
10	Content objectives clearly described	54(90.0)	0	6(10.0)	0	90.0	10.0
11	Australian biology adequate	57(95.0)	0	3(5.0)	0	95.0	5.0
12	Biology presented is relevant	39(65.6)	0	19(32.8)	1(1.7)	67.2	32.8
13	Covers all levels of organization	34(56.7)	7(11.7)	6(10.0)	13(21.6)	78.3	21.7
14	Contains too much human biology (1)	14(23.3)	2(3.4)	36(60.0)	8(13.3)	63.4	36.6

(1) Item with part 'b' negative

TABLE 3

Teacher responses to the items in the categories Learning Skills and Philosophy of the Course

Item	Responses to part (a) and (b)				Degree of	
	(a)Agree (b)Agree n(%)	Agree Disagree n(%)	Disagree Agree n(%)	Disagree Disagree n(%)	Satis-faction %	Dissatis-faction %
Learning Skills						
15 Fosters learning skills relevant to science	52(88.1)	0	7(11.9)	0	88.1	11.9
16 Learning skills transferable	51(86.4)	0	4(6.8)	4(6.8)	93.2	6.8
17 Concept approach too difficult (1)	23(39.0)	19(32.2)	14(23.7)	3(5.1)	55.9	44.1
18 Few facts to learn	18(26.7)	10(16.6)	4(6.7)	30(50.0)	76.7	23.3
19 Too many questions and problems (1)	24(40.0)	24(40.0)	10(16.7)	2(3.3)	56.7	43.3
Philosophy of the Course						
20 Sound philosophical base	56(93.3)	0	4(6.7)	0	93.3	6.7
21 Inquiry based	50(86.2)	1(1.7)	3(5.1)	4(7.0)	93.2	6.8
22 Sound scientific approach	53(88.3)	0	5(8.3)	2(3.4)	91.7	8.3
23 Allows experimental activity	52(86.6)	0	8(13.4)	0	86.6	13.4
24 Student-centred	53(89.9)	1(1.7)	5(8.4)	0	89.9	10.1
25 Teachers understand the philosophy	28(46.7)	0	30(50.0)	2(3.3)	50.0	50.0
26 Students gain from inquiry	24(40.0)	0	31(51.7)	5(8.3)	48.3	51.7
27 Teachers not well prepared to teach course (2)	45(75.0)	1(1.7)	14(23.3)	0	25.0	75.0

(1) Items with part 'b' negative
(2) Items with part 'a' negative

TABLE 4
Teacher responses to the items in the categories
Assessment of Student Achievement, Tertiary Entrance Examination and Management

Item	Responses to part (a) and (b) (a)Agree (b)Agree n(%)	Agree Disagree n(%)	Disagree Agree n(%)	Disagree Disagree n(%)	Degree of Satis-faction %	Dissatis-faction %
Assessment of Student Achievement						
28 General objectives readily achieved	40(66.7)	0	20(33.3)	0	67.7	33.3
29 Specific objectives readily assessed	47(79.7)	1(1.7)	11(18.6)	0	79.7	20.3
30 Teachers do not assess all objectives (3)	41(68.3)	13(21.7)	2(3.3)	4(6.7)	75.0	25.0
31 Some objectives need not be assessed (3)	46(78.0)	11(18.6)	0	2(3.4)	81.4	18.6
32 Students can assess their own learning	13(22.0)	0	35(59.3)	11(18.7)	40.7	59.3
Tertiary Entrance Exam						
33 Reliable indicator of ability in biology	30(50.9)	0	22(37.3)	7(11.8)	63.7	37.3
34 Adequately tests syllabus objectives	35(59.3)	0	23(39.0)	1(1.7)	61.0	39.0
35 TEE influences type of course taught	9(15.0)	43(71.7)	1(1.7)	7(11.6)	26.6	73.4
36 Teachers over-emphasise importance of TEE (1)	32(54.2)	10(16.9)	12(20.4)	5(8.5)	37.3	62.7
37 TEE restricts able students' interests in biology (1)	40(67.8)	2(3.4)	17(28.8)	0	32.2	67.8
Management						
38 Most lessons are conducted in labs	50(86.2)	3(5.2)	4(6.9)	1.7(1.0)	87.9	12.1
39 Students expected to have high workload out of school (1)	11(18.6)	46(78.0)	1(1.7)	1(1.7)	79.2	20.3
40 School administration decisions do not reduce teacher/ student contact time (3)	27(45.8)	0	28(47.5)	4(6.7)	52.5	47.5
41 Class size has no effect on enquiry mode of teaching (3)	6(10.2)	0	5(8.5)	48(81.3)	91.5	8.5

1 Items with part 'b' negative
3 Items with parts 'a' and 'b' negative

TABLE 5

Teacher responses to the items in the categories Teacher Characteristics and Student Characteristics

Item	Responses to part (a) and (b)				Degree of	
	(a)Agree (b)Agree n(%)	Agree Disagree n(%)	Disagree Agree n(%)	Disagree Disagree n(%)	Satis-faction %	Dissatis-faction %
Teacher Characteristics						
42 Skills to conduct inquiry learning	22(36.7)	0	37(61.6)	1(1.7)	38.4	61.6
43 Teachers have desire to use inquiry	24(40.0)	0	28(38.3)	13(21.7)	61.7	38.3
44 Inquiry is a productive way to teach	23(39.0)	2(3.4)	23(39.0)	11(18.6)	57.6	42.4
45 Have scientific background	50(84.7)	0	9(15.3)	0	84.7	15.3
46 Enough in-service background	2(3.3)	6(10.0)	50(83.4)	2(3.3)	6.6	93.4
Student Characteristics						
47 Academic achievement, low priority (1)	30(50.8)	8(13.6)	8(32.2)	2(3.4)	45.8	54.2
48 Large proportion of low ability students (1)	29(49.1)	10(16.9)	16(27.2)	4(6.8)	44.1	55.9
49 Decline in proportion of high ability students (1)	38(63.3)	3(5.0)	19(31.7)	0	36.7	63.3
50 Students do not spend adequate time on biology at home (2)	42(71.2)	0	16(27.1)	1(1.7)	27.1	72.9

1 Items with part 'b' negative
2 Items with part 'a' negative

24a The course is student-centred
24b The course should be student-centred

Response Pattern		Message
24a	Agree	I perceive the course is student-centred and since I believe
24b	Agree	that it should be, I am satisfied with this issue.
24a	Agree	I perceive the course is student-centred and because I believe
24b	Disagree	that it should not be, I am dissatisfied with this issue.
24a	Disagree	I perceive the course is not student-centred and since I
24b	Agree	believe that it should be, I am dissatisfied with this issue.
24a	Disagree	I perceive the course is not student-centred and because I
24b	Disagree	believe that it should not be, I am satisfied with this issue.

Figure 1 Response patterns and messages conveyed for a typical item in the Teachers' Perception and Opinion Questionnaire